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EXAMINER

THOMPSON, JAMES A

ART UNIT PAPER NUMBER

2624

3

DATE MAILED: 07/15/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/727,609

Applicant(s)

KEMPF, JEFFREY

Examiner

James A Thompson

Art Unit

2624

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☒ Claim(s) 12 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 December 2000 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date ____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

DETAILED ACTION

Drawings

1. Figure 2 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: "516" in figure 5. Corrected drawing sheets, or amendment to the specification to add the reference character(s) in the description, are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective

action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

3. Claim 12 is objected to because of the following informalities: Line 12 of claim 12 has a period at the end although the text of said claim is not complete. Therefore, it should have a semicolon in place of a period. Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 7, 9 and 16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 7, 9 and 16 each refer to "generating a first and second pseudo random number". However, claims 7, 9 and 16 later refer to "adding said pseudo random number to said first portion"; claims 7 and 16 refer to "adding said pseudo random number to said second portion"; and claim 9 refers to "subtracting said pseudo random number from said second portion" when there are two distinct pseudo random numbers specified. It is therefore indefinite as to which pseudo random number is being used in which instance.

Claim Interpretations

6. For the purpose of examining the claims over the prior art, the Examiner made the following interpretations:

- a. In claim 7, line 6, "adding said pseudo random number to said first portion" will be interpreted to mean "adding said first pseudo random number to said first portion".
- b. In claim 7, line 8, "adding said pseudo random number to said second portion" will be interpreted to mean "adding said second pseudo random number to said second portion".
- c. In claim 9, line 6, "adding said pseudo random number to said first portion" will be interpreted to mean "adding said first pseudo random number to said first portion".
- d. In claim 9, line 8, "subtracting said pseudo random number from said second portion" will be interpreted to mean "subtracting said second pseudo random number from said second portion".
- e. In claim 16, line 6, "adding said pseudo random number to said first portion" will be interpreted to mean "adding said first pseudo random number to said first portion".
- f. In claim 16, line 8, "adding said pseudo random number to said second portion" will be interpreted to mean "adding said second pseudo random number to said second portion".

Whether a pseudo-random number is referred to as the first pseudo random number or the second pseudo-random number is arbitrary. Claims 7 and 16 are simply distinguishing between the two. It is obvious from the context of the claims, however, that one of the pseudo-random numbers is meant for said first portion and the other pseudo-random number is meant for said second portion.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

8. Claim 1 is rejected under 35 U.S.C. 102(a) as being anticipated by Nguyen (US Patent 5,892,851).

Regarding claim 1: Nguyen discloses a method of performing error diffusion comprising the step of simultaneously processing image data for at least two pixels (figure 5(100,500(associated pixels)) of Nguyen) in a row of pixels (figure 5(510) of Nguyen), said at least two pixels comprising a first group of pixels (figure 5(100 (associated pixels)) of Nguyen) and a last pixel (figure 5(500(associated pixels)) of Nguyen) (column 4, lines 1-7 of Nguyen). A four-weight filter (figure 5(100) of Nguyen) is applied to all but the last one of the pixels in a segment of the image row (column 4, lines 6-7 of Nguyen) and a three-weight filter (figure 5(500) of Nguyen) is applied to the last pixel in said segment (column 4, lines 4-5 of Nguyen). Each segment of the image

row is computed in parallel (column 3, lines 55-59 of Nguyen). The image rows (figure 5(510) of Nguyen) are processed one image row at a time (column 3, lines 18-19 of Nguyen), as demonstrated in the example embodiment in column 5, lines 35-40 of Nguyen. Since the next image row is to be processed next, then the last pixel abuts the group of pixels to be processed next.

Nguyen further discloses reducing the precision of said image data to produce a modified image data word (column 3, lines 7-10 of Nguyen) and an error word for each pixel (column 3, lines 5-7 of Nguyen). Since the image is originally a continuous-tone image and is transformed into a halftone image (column 3, lines 7-10 of Nguyen), then the precision of said modified image data is reduced since a halftone image, by definition, comprises only one bit per pixel and a continuous-tone image, by definition, comprises more than one bit per pixel. Error diffusion processing of image data (column 3, lines 5-7 of Nguyen), by definition, produces an error word for each pixel based on the difference between the halftone value and the original continuous-tone value, and then diffuses said error to other pixels.

Nguyen further discloses propagating a portion of said error word for each pixel in said first group to two pixels in a next row of pixels (figure 5(100(associated pixels)); column 3, lines 21-25; and column 4, lines 6-7 of Nguyen). The four-weight filter (figure 5(100) of Nguyen) is used for all of the pixels of the segment except for the last one (figure 5 and column 4, lines 6-7 of Nguyen). A portion of said error word for each pixel using said four-weight pixel (first group) is propagated to two pixels (figure 3(360,370) of Nguyen) in the next row of pixels, as demonstrated by the error diffusion arrows of

figure 5(100) of Nguyen and the error diffusion propagation shown in figure 3 of Nguyen in which the error of pixel **100** is propagated to pixels **360** and **370**, which are clearly in the next row to be processed (column 3, lines 21-25 of Nguyen).

Nguyen further discloses propagating a first portion of said error word for said last pixel to a pixel in said next row of pixels and a second portion of said error word for said last pixel to a pixel in said group of pixels to be processed next (figure 5(500 (associated pixels)) and column 4, lines 1-5 of Nguyen). Figure 6 of Nguyen shows the three-weight filter (column 2, lines 53-55 of Nguyen) used for the last pixel of each segment (column 4, lines 4-5 of Nguyen). Error is propagated from said last pixel into the next row using said three-weight filter (column 4, lines 1-5 of Nguyen). As can clearly be seen from figure 5 of Nguyen, the error portions corresponding to figure 6(630) and figure 6(620) of Nguyen (first portion) are each propagated to a pixel in said next row of pixels and the error portion corresponding to figure 6(610) of Nguyen (second portion) is propagated into the first pixel of the segment below and to the right of said last pixel. The segment below and to the right of said last pixel is to be processed next since all segments of a row are processed in parallel (column 3, lines 55-59 of Nguyen).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen (US Patent 5,892,851) in view of Delabastita (US Patent 6,118,513).

Regarding claim 12: Nguyen discloses a display system (figure 2 of Nguyen) comprising a controller (figure 2(200) of Nguyen) for receiving and processing pixelated image data (column 3, lines 5-10 of Nguyen). Said controller performs the method of claim 1, the arguments of which are incorporated herein.

Nguyen does not disclose expressly a light source for generating a beam of light along a first light path; and a light modulator for selectively modulating light along said first light path in response to image data signals from said controller.

Delabastita discloses a light source (figure 1(3) of Delabastita) for generating a beam of light along a first light path (column 3, lines 45-49 of Delabastita); and a light modulator (figure 1(9) of Delabastita) for selectively modulating light along said first light path in response to image data signals from said controller (column 3, lines 49-55 of Delabastita). The hardware (figure 1(9) of Delabastita) controls the rasterization of the image based on the received density values (column 3, lines 49-55 of Delabastita). The density values are processed using error diffusion (column 3, line 67 to column 4, line 4 of Delabastita) and compared with a threshold, which results in outputting either a 1 or a 0 (column 4, lines 4, lines 4-12 of Delabastita).

Nguyen and Delabastita are combinable because they are from the same field of endeavor, namely image data processing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the device of Delabastita to

output the halftone data determined by the system of Nguyen. The motivation for doing so would have been to be able to copy the halftoned image data onto light-sensitive materials (column 4, lines 45-50 of Delabastita). Therefore, it would have been obvious to combine Delabastita with Nguyen to obtain the invention as specified in claim 12.

11. Claims 2-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen (US Patent 5,892,851) in view of Shiau (US Patent 5,880,857).

Regarding claim 2: Nguyen discloses dividing the error word for each pixel in the first group (figure 5(100) of Nguyen) into a first and second portion (column 3, lines 21-25 of Nguyen). The error word is diffused to other pixels using Floyd-Steinberg error diffusion (column 3, lines 21-25 of Nguyen), which diffuses the error word in portions (column 4, lines 27-32 of Nguyen). The process of error diffusion adds said first and second error words to image data for a first (figure 3(360) of Nguyen) and second pixel (figure 3(370) of Nguyen) in the next row of pixels (figure 3 and column 3, lines 21-25 of Nguyen). As defined in the art, error diffusion requires that the weighted, diffused errors be added to the appropriate pixels in order to propagate the thresholding error for each pixel.

Nguyen does not disclose expressly generating a pseudo-random number; subtracting said pseudo-random number from said first portion to produce a first modified error word; and adding said pseudo-random number to said second portion to produce a second modified error word.

Shiau discloses generating a pseudo-random number (column 5, lines 15-18 of Shiau); and adding said pseudo-random number to image values (column 5, lines 29-32 of Shiau). The pseudo-random number can be positive or negative (column 5, lines 17-18 of Shiau). The addition of a negative pseudo-random number is the same as the subtraction of a positive pseudo-random number of the same magnitude.

Nguyen and Shiau are combinable because they are from the same field of endeavor, namely error diffusion of image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to subtract a pseudo-random number from said first portion, thus producing a first modified error word; and add said pseudo-random number to said second portion, thus producing a second modified error word. If said pseudo-random number is subtracted from said first portion, said pseudo-random number would need to be added to said second portion since, as is well known in the art, the total weights from an error diffusion filter need to add up to about 1, but no more than 1, in order to maintain numerical stability. The motivation for doing so would have been to defeat visual artifacts of a regular and deterministic nature (column 1, line 66 to column 2, line 1 of Shiau). Therefore, it would have been obvious to combine Shiau with Nguyen to obtain the invention as specified in claim 2.

Regarding claim 3: Nguyen discloses that said first modified error word is added to image pixel data for a pixel (figure 3(360) of Nguyen) directly below the pixel (figure 3(310) of Nguyen) generating the error signal (column 3, lines 21-25 of Nguyen). The application of error diffusion (column 3, lines 21-25 of Nguyen) implies that a

weighted error word, such as said first modified error word, is added to a corresponding pixel since, as is well known in the art, this is the basic process of error diffusion.

Regarding claim 4: Nguyen discloses that said second modified error word is added to image pixel data for a pixel (figure 3(370) of Nguyen) directly below and to the right of the pixel (figure 3(310) of Nguyen) generating the error signal (column 3, lines 21-25 of Nguyen).

Regarding claim 5: Nguyen discloses dividing the error word for each pixel in the second group (figure 5(500) of Nguyen) into a first (figure 6(620) of Nguyen) and second portion (figure 6(610) of Nguyen) (column 4, lines 4-5 and lines 27-32 of Nguyen). The error word is diffused to other pixels using a modified Floyd-Steinberg error diffusion (column 4, lines 27-29 of Nguyen), which diffuses the error word in portions (column 4, lines 27-32 of Nguyen). For said second group, the error filter is modified from what is shown in figure 3 to redistribute the error diffusion that would normally go from figure 3(310) to figure 3(330) of Nguyen (column 3, lines 59-62 of Nguyen). The process of error diffusion adds said first error word to image data for a pixel (figure 3(360) of Nguyen) in the next row of pixels (figure 3 and column 3, lines 21-25 of Nguyen). Since each segment of a row is processed in parallel by rows (column 3, lines 55-59 of Nguyen), said second error word is added to image data for a pixel (figure 3(370) of Nguyen) in said group of pixels to be processed next (figure 5 and column 3, lines 21-25 of Nguyen). As can be seen in figure 5 of Nguyen, the pixel to which said second error word is added (figure 3(370) of Nguyen) is in the segment

which is below the segment that is the immediate right of the last pixel (figure 3(310) of Nguyen), and is thus in said group of pixels to be processed next.

Nguyen does not disclose expressly generating a pseudo-random number; subtracting said pseudo-random number from said first portion to produce a first modified error word; and adding said pseudo-random number to said second portion to produce a second modified error word.

Shiau discloses generating a pseudo-random number (column 5, lines 15-18 of Shiau); and adding said pseudo-random number to image values (column 5, lines 29-32 of Shiau). The pseudo-random number can be positive or negative (column 5, lines 17-18 of Shiau). The addition of a negative pseudo-random number is the same as the subtraction of a positive pseudo-random number of the same magnitude.

Nguyen and Shiau are combinable because they are from the same field of endeavor, namely error diffusion of image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to subtract a pseudo-random number from said first portion, thus producing a first modified error word; and add said pseudo-random number to said second portion, thus producing a second modified error word. If said pseudo-random number is subtracted from said first portion, said pseudo-random number would need to be added to said second portion since, as is well known in the art, the total weights from an error diffusion filter need to add up to about 1, but no more than 1, in order to maintain numerical stability. The motivation for doing so would have been to defeat visual artifacts of a regular and deterministic nature (column 1, line

66 to column 2, line 1 of Shiau). Therefore, it would have been obvious to combine Shiau with Nguyen to obtain the invention as specified in claim 5.

Regarding claim 6: The arguments regarding claim 5 are incorporated herein. As stated, the pseudo-random number can be positive or negative (column 5, lines 17-18 of Shiau); and the addition of a negative pseudo-random number is the same as the subtraction of a positive pseudo-random number of the same magnitude. Therefore, adding said pseudo random number to said first portion, as stated in claim 6, performs the same operations as adding a negative pseudo random number to said first portion, which is the subtraction stated in claim 5. Likewise, adding a negative pseudo random number, which is the subtraction stated in claim 6, to said second portion performs the same operations as adding a pseudo random number to said second portion, as stated in claim 5. Furthermore, if said pseudo-random number is added to said first portion, said pseudo-random number would need to be subtracted from said second portion since, as is well known in the art, the total weights from an error diffusion filter need to add up to about 1, but no more than 1, in order to maintain numerical stability.

Regarding claim 7: Nguyen discloses dividing the error word for each pixel in the first group (figure 5(100) of Nguyen) into a first and second portion (column 3, lines 21-25 of Nguyen). The error word is diffused to other pixels using Floyd-Steinberg error diffusion (column 3, lines 21-25 of Nguyen), which diffuses the error word in portions (column 4, lines 27-32 of Nguyen). The process of error diffusion adds said first and second error words to image data for a first (figure 3(360) of Nguyen) and second pixel

(figure 3(370) of Nguyen) in the next row of pixels (figure 3 and column 3, lines 21-25 of Nguyen).

Nguyen does not disclose expressly generating a first and second pseudo-random number; adding said first pseudo-random number to said first portion to produce a first modified error word; and adding said second pseudo-random number to said second portion to produce a second modified error word.

Shiau discloses generating a plurality of pseudo-random numbers (column 5, lines 15-18 of Shiau); and adding said pseudo-random numbers to image values (column 5, lines 29-32 of Shiau).

Nguyen and Shiau are combinable because they are from the same field of endeavor, namely error diffusion of image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to add the first of a plurality of pseudo-random numbers to said first portion, thus producing a first modified error word; and add the second of a plurality of pseudo-random numbers to said second portion, thus producing a second modified error word. The motivation for doing so would have been to defeat visual artifacts of a regular and deterministic nature (column 1, line 66 to column 2, line 1 of Shiau). Therefore, it would have been obvious to combine Shiau with Nguyen to obtain the invention as specified in claim 7.

Regarding claim 8: Nguyen discloses dividing the error word for each pixel in the second group (figure 5(500) of Nguyen) into a first (figure 6(620) of Nguyen) and second portion (figure 6(610) of Nguyen) (column 4, lines 4-5 and lines 27-32 of Nguyen). The error word is diffused to other pixels using a modified Floyd-Steinberg

error diffusion (column 4, lines 27-29 of Nguyen), which diffuses the error word in portions (column 4, lines 27-32 of Nguyen). For said second group, the error filter is modified from what is shown in figure 3 to redistribute the error diffusion that would normally go from figure 3(310) to figure 3(330) of Nguyen (column 3, lines 59-62 of Nguyen). The process of error diffusion adds said first error word to image data for a pixel (figure 3(360) of Nguyen) in the next row of pixels (figure 3 and column 3, lines 21-25 of Nguyen). Since each segment of a row is processed in parallel by rows (column 3, lines 55-59 of Nguyen), said second error word is added to image data for a pixel (figure 3(370) of Nguyen) in said group of pixels to be processed next (figure 5 and column 3, lines 21-25 of Nguyen). As can be seen in figure 5 of Nguyen, the pixel to which said second error word is added (figure 3(370) of Nguyen) is in the segment which is below the segment to the immediate right of the last pixel (figure 3(310) of Nguyen), and is thus in said group of pixels to be processed next.

Nguyen does not disclose expressly generating a first and second pseudo-random number; adding said first pseudo-random number to said first portion to produce a first modified error word; and adding said second pseudo-random number to said second portion to produce a second modified error word.

Shiau discloses generating a plurality of pseudo-random numbers (column 5, lines 15-18 of Shiau); and adding said pseudo-random numbers to image values (column 5, lines 29-32 of Shiau).

Nguyen and Shiau are combinable because they are from the same field of endeavor, namely error diffusion of image data. At the time of the invention, it would

have been obvious to a person of ordinary skill in the art to add the first of a plurality of pseudo-random numbers to said first portion, thus producing a first modified error word; and add the second of a plurality of pseudo-random numbers to said second portion, thus producing a second modified error word. The motivation for doing so would have been to defeat visual artifacts of a regular and deterministic nature (column 1, line 66 to column 2, line 1 of Shiao). Therefore, it would have been obvious to combine Shiao with Nguyen to obtain the invention as specified in claim 8.

Regarding claim 9: The arguments regarding claim 7 are incorporated herein. As stated, the pseudo-random number can be positive or negative (column 5, lines 17-18 of Shiao); and the addition of a negative pseudo-random number is the same as the subtraction of a positive pseudo-random number of the same magnitude. Therefore, adding a negative second pseudo random number, which is the subtraction stated in claim 9, to said second portion performs the same operations as adding a second pseudo random number to said second portion, as stated in claim 7. Furthermore, if both the first pseudo-random number and second pseudo-random number are positive and the first pseudo-random number is added to said first portion, then said second pseudo-random number should be subtracted from said second portion. As is well known in the art, the total weights from an error diffusion filter need to add up to about 1, but no more than 1, in order to maintain numerical stability. Subtracting the second pseudo-random number from said second portion will help achieve numerical stability.

Regarding claim 10: The arguments regarding claim 8 are incorporated herein. As stated, the pseudo-random number can be positive or negative (column 5, lines 17-

18 of Shiau); and the addition of a negative pseudo-random number is the same as the subtraction of a positive pseudo-random number of the same magnitude. Therefore, adding a negative second pseudo random number, which is the subtraction stated in claim 10, to said second portion performs the same operations as adding a second pseudo random number to said second portion, as stated in claim 8. Furthermore, if both the first pseudo-random number and second pseudo-random number are positive and the first pseudo-random number is added to said first portion, then said second pseudo-random number should be subtracted from said second portion. As is well known in the art, the total weights from an error diffusion filter need to add up to about 1, but no more than 1, in order to maintain numerical stability. Subtracting the second pseudo-random number from said second portion will help achieve numerical stability.

Regarding claim 11: The arguments regarding claim 8 are incorporated herein. As stated, the pseudo-random number can be positive or negative (column 5, lines 17-18 of Shiau); and the addition of a negative pseudo-random number is the same as the subtraction of a positive pseudo-random number of the same magnitude. Therefore, adding a negative first pseudo random number to said first portion, which is the subtraction stated in claim 11, performs the same operations as adding a first pseudo random number to said first portion, as stated in claim 8. Furthermore, if both the first pseudo-random number and second pseudo-random number are positive and the first pseudo-random number is subtracted from said first portion, then said second pseudo-random number should be added to said second portion. As is well known in the art, the total weights from an error diffusion filter need to add up to about 1, but no more

than 1, in order to maintain numerical stability. Adding the second pseudo-random number to said second portion will help achieve numerical stability.

12. Claims 13-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen (US Patent 5,892,851) in view of Delabastita (US Patent 6,118,513) and Shiau (US Patent 5,880,857).

Regarding claim 13: Nguyen discloses that said controller (figure 2(200) of Nguyen) divides the error word for each pixel in the first group (figure 5(100) of Nguyen) into a first and second portion (column 3, lines 21-25 of Nguyen). The error word is diffused to other pixels using Floyd-Steinberg error diffusion (column 3, lines 21-25 of Nguyen), which diffuses the error word in portions (column 4, lines 27-32 of Nguyen). The process of error diffusion adds said first and second error words to image data for a first (figure 3(360) of Nguyen) and second pixel (figure 3(370) of Nguyen) in the next row of pixels (figure 3 and column 3, lines 21-25 of Nguyen).

Nguyen in view of Delabastita does not disclose expressly generating a pseudo-random number; subtracting said pseudo-random number from said first portion to produce a first modified error word; and adding said pseudo-random number to said second portion to produce a second modified error word.

Shiau discloses generating a pseudo-random number (column 5, lines 15-18 of Shiau); and adding said pseudo-random number to image values (column 5, lines 29-32 of Shiau). The pseudo-random number can be positive or negative (column 5, lines 17-

18 of Shiau). The addition of a negative pseudo-random number is the same as the subtraction of a positive pseudo-random number of the same magnitude.

Nguyen in view of Delabastita is combinable with Shiau because they are from the same field of endeavor, namely image data processing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to have said controller subtract a pseudo-random number from said first portion, thus producing a first modified error word; and add said pseudo-random number to said second portion, thus producing a second modified error word. If said pseudo-random number is subtracted from said first portion, said pseudo-random number would need to be added to said second portion since, as is well known in the art, the total weights from an error diffusion filter need to add up to about 1, but no more than 1, in order to maintain numerical stability. The motivation for doing so would have been to defeat visual artifacts of a regular and deterministic nature (column 1, line 66 to column 2, line 1 of Shiau). Therefore, it would have been obvious to combine Shiau with Nguyen in view of Delabastita to obtain the invention as specified in claim 13.

Regarding claim 14: Nguyen discloses that said controller (figure 2(200) of Nguyen) divides the error word for each pixel in the second group (figure 5(500) of Nguyen) into a first (figure 6(620) of Nguyen) and second portion (figure 6(610) of Nguyen) (column 4, lines 4-5 and lines 27-32 of Nguyen). The error word is diffused to other pixels using a modified Floyd-Steinberg error diffusion (column 4, lines 27-29 of Nguyen), which diffuses the error word in portions (column 4, lines 27-32 of Nguyen). For said second group, the error filter is modified from what is shown in figure 3 to

redistribute the error diffusion that would normally go from figure 3(310) to figure 3(330) of Nguyen (column 3, lines 59-62 of Nguyen). The process of error diffusion adds said first error word to image data for a pixel (figure 3(360) of Nguyen) in the next row of pixels (figure 3 and column 3, lines 21-25 of Nguyen). Since each segment of a row is processed in parallel by rows (column 3, lines 55-59 of Nguyen), said second error word is added to image data for a pixel (figure 3(370) of Nguyen) in said group of pixels to be processed next (figure 5 and column 3, lines 21-25 of Nguyen). As can be seen in figure 5 of Nguyen, the pixel to which said second error word is added (figure 3(370) of Nguyen) is in the segment which is below the segment to the immediate right of the last pixel (figure 3(310) of Nguyen), and is thus in said group of pixels to be processed next.

Nguyen in view of Delabastita does not disclose expressly generating a pseudo-random number; subtracting said pseudo-random number from said first portion to produce a first modified error word; and adding said pseudo-random number to said second portion to produce a second modified error word.

Shiau discloses generating a pseudo-random number (column 5, lines 15-18 of Shiau); and adding said pseudo-random number to image values (column 5, lines 29-32 of Shiau). The pseudo-random number can be positive or negative (column 5, lines 17-18 of Shiau). The addition of a negative pseudo-random number is the same as the subtraction of a positive pseudo-random number of the same magnitude.

Nguyen in view of Delabastita is combinable with Shiau because they are from the same field of endeavor, namely image data processing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to have said controller

subtract a pseudo-random number from said first portion, thus producing a first modified error word; and add said pseudo-random number to said second portion, thus producing a second modified error word. If said pseudo-random number is subtracted from said first portion, said pseudo-random number would need to be added to said second portion since, as is well known in the art, the total weights from an error diffusion filter need to add up to about 1, but no more than 1, in order to maintain numerical stability. The motivation for doing so would have been to defeat visual artifacts of a regular and deterministic nature (column 1, line 66 to column 2, line 1 of Shiau). Therefore, it would have been obvious to combine Shiau with Nguyen in view of Delabastita to obtain the invention as specified in claim 14.

Regarding claim 15: The arguments regarding claim 14 are incorporated herein. As stated, the pseudo-random number can be positive or negative (column 5, lines 17-18 of Shiau); and the addition of a negative pseudo-random number is the same as the subtraction of a positive pseudo-random number of the same magnitude. Therefore, adding said pseudo random number to said first portion, as stated in claim 15, performs the same operations as adding a negative pseudo random number to said first portion, which is the subtraction stated in claim 14. Likewise, adding a negative pseudo random number, which is the subtraction stated in claim 15, to said second portion performs the same operations as adding a pseudo random number to said second portion, as stated in claim 14. Furthermore, if said pseudo-random number is added to said first portion, said pseudo-random number would need to be subtracted from said second portion since, as is well known in the art, the total weights from an

error diffusion filter need to add up to about 1, but no more than 1, in order to maintain numerical stability.

Regarding claim 16: Nguyen discloses that said controller (figure 2(200) of Nguyen) divides the error word for each pixel in the first group (figure 5(100) of Nguyen) into a first and second portion (column 3, lines 21-25 of Nguyen). The error word is diffused to other pixels using Floyd-Steinberg error diffusion (column 3, lines 21-25 of Nguyen), which diffuses the error word in portions (column 4, lines 27-32 of Nguyen). The process of error diffusion adds said first and second error words to image data for a first (figure 3(360) of Nguyen) and second pixel (figure 3(370) of Nguyen) in the next row of pixels (figure 3 and column 3, lines 21-25 of Nguyen).

Nguyen in view of Delabastita does not disclose expressly generating a first and second pseudo-random number; adding said first pseudo-random number to said first portion to produce a first modified error word; and adding said second pseudo-random number to said second portion to produce a second modified error word.

Shiau discloses generating a plurality of pseudo-random numbers (column 5, lines 15-18 of Shiau); and adding said pseudo-random numbers to image values (column 5, lines 29-32 of Shiau).

Nguyen in view of Delabastita is combinable with Shiau because they are from the same field of endeavor, namely image data processing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use said controller to add the first of a plurality of pseudo-random numbers to said first portion, thus producing a first modified error word; and add the second of a plurality of pseudo-

random numbers to said second portion, thus producing a second modified error word. The motivation for doing so would have been to defeat visual artifacts of a regular and deterministic nature (column 1, line 66 to column 2, line 1 of Shiau). Therefore, it would have been obvious to combine Shiau with Nguyen in view of Delabastita to obtain the invention as specified in claim 16.

Regarding claim 17: Nguyen discloses that said controller (figure 2(200) of Nguyen) divides the error word for each pixel in the second group (figure 5(500) of Nguyen) into a first (figure 6(620) of Nguyen) and second portion (figure 6(610) of Nguyen) (column 4, lines 4-5 and lines 27-32 of Nguyen). The error word is diffused to other pixels using a modified Floyd-Steinberg error diffusion (column 4, lines 27-29 of Nguyen), which diffuses the error word in portions (column 4, lines 27-32 of Nguyen). For said second group, the error filter is modified from what is shown in figure 3 to redistribute the error diffusion that would normally go from figure 3(310) to figure 3(330) of Nguyen (column 3, lines 59-62 of Nguyen). The process of error diffusion adds said first error word to image data for a pixel (figure 3(360) of Nguyen) in the next row of pixels (figure 3 and column 3, lines 21-25 of Nguyen). Since each segment of a row is processed in parallel by rows (column 3, lines 55-59 of Nguyen), said second error word is added to image data for a pixel (figure 3(370) of Nguyen) in said group of pixels to be processed next (figure 5 and column 3, lines 21-25 of Nguyen). As can be seen in figure 5 of Nguyen, the pixel to which said second error word is added (figure 3(370) of Nguyen) is in the segment which is below the segment to the immediate right of the last pixel (figure 3(310) of Nguyen), and is thus in said group of pixels to be processed next.

Nguyen in view of Delabastita does not disclose expressly generating a first and second pseudo-random number; adding said first pseudo-random number to said first portion to produce a first modified error word; and adding said second pseudo-random number to said second portion to produce a second modified error word.

Shiau discloses generating a plurality of pseudo-random numbers (column 5, lines 15-18 of Shiau); and adding said pseudo-random numbers to image values (column 5, lines 29-32 of Shiau).

Nguyen in view of Delabastita is combinable with Shiau because they are from the same field of endeavor, namely image data processing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to have said controller add the first of a plurality of pseudo-random numbers to said first portion, thus producing a first modified error word; and add the second of a plurality of pseudo-random numbers to said second portion, thus producing a second modified error word. The motivation for doing so would have been to defeat visual artifacts of a regular and deterministic nature (column 1, line 66 to column 2, line 1 of Shiau). Therefore, it would have been obvious to combine Shiau with Nguyen in view of Delabastita to obtain the invention as specified in claim 17.

Regarding claim 18: The arguments regarding claim 16 are incorporated herein. As stated, the pseudo-random number can be positive or negative (column 5, lines 17-18 of Shiau); and the addition of a negative pseudo-random number is the same as the subtraction of a positive pseudo-random number of the same magnitude. Therefore, adding a negative second pseudo random number, which is the subtraction

stated in claim 18, to said second portion performs the same operations as adding a second pseudo random number to said second portion, as stated in claim 16.

Furthermore, if both the first pseudo-random number and second pseudo-random number are positive and the first pseudo-random number is added to said first portion, then said second pseudo-random number should be subtracted from said second portion. As is well known in the art, the total weights from an error diffusion filter need to add up to about 1, but no more than 1, in order to maintain numerical stability. Subtracting the second pseudo-random number from said second portion will help achieve numerical stability.

Regarding claim 19: The arguments regarding claim 17 are incorporated herein. As stated, the pseudo-random number can be positive or negative (column 5, lines 17-18 of Shiau); and the addition of a negative pseudo-random number is the same as the subtraction of a positive pseudo-random number of the same magnitude. Therefore, adding a negative second pseudo random number, which is the subtraction stated in claim 19, to said second portion performs the same operations as adding a second pseudo random number to said second portion, as stated in claim 17. Furthermore, if both the first pseudo-random number and second pseudo-random number are positive and the first pseudo-random number is added to said first portion, then said second pseudo-random number should be subtracted from said second portion. As is well known in the art, the total weights from an error diffusion filter need to add up to about 1, but no more than 1, in order to maintain numerical stability.

Subtracting the second pseudo-random number from said second portion will help achieve numerical stability.

Regarding claim 20: The arguments regarding claim 17 are incorporated herein. As stated, the pseudo-random number can be positive or negative (column 5, lines 17-18 of Shiao); and the addition of a negative pseudo-random number is the same as the subtraction of a positive pseudo-random number of the same magnitude. Therefore, adding a negative first pseudo random number to said first portion, which is the subtraction stated in claim 20, performs the same operations as adding a first pseudo random number to said first portion, as stated in claim 17. Furthermore, if both the first pseudo-random number and second pseudo-random number are positive and the first pseudo-random number is subtracted from said first portion, then said second pseudo-random number should be added to said second portion. As is well known in the art, the total weights from an error diffusion filter need to add up to about 1, but no more than 1, in order to maintain numerical stability. Adding the second pseudo-random number to said second portion will help achieve numerical stability.

Conclusion

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Toshiaki Kakutani, US Patent 5,627,659, 6 May 1997.

Michael D. McGuire, EP 0 631 428 A2, 28 December 1994.

Chen et al., EP 0 863 661 A2, 9 September 1998.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James A Thompson whose telephone number is 703-305-6329. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David K Moore can be reached on 703-308-7452. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Examiner
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June 30, 2004



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